

Content Submission Guidelines

New datasets are always welcome for Science On a Sphere®! By following a few simple guidelines, new datasets can be added to the SOS Dataset Catalog and released to the SOS Users Collaborative Network in a timely manner.

How Science On a Sphere® uses data

There are two basic modes of operation for SOS:

Single Image

Can be displayed on the sphere and animated, as in a planetary rotation. An example of this is a global image of the Earth's topography and bathymetry. It's a static image that can be manipulated and rotated in real time from the user interface or remote control

Image Sequence or an MPEG4

Animates through time. An example of this would be a loop of satellite data. For an image sequence, SOS will display the images in sequence and play them like a movie across the entire sphere surface. Image sequences can be of any arbitrary length, limited mainly by disk space and can be animated at frame rates up to 30 frames per second. Transitions, special effects, and other computer graphics techniques can be added to a sequence through the use of off the shelf software like Final Cut Pro. MPEG4's allow for higher resolution and faster frame rates than image sequences.

Data Format

Map Projection – Equatorial Cylindrical Equidistant Projection

This is a simple latitude/longitude grid where the image is twice as wide as it is tall. To be consistent with the SOS Data Catalog, it is recommended that the 0° line go through the middle of the map, with the +/-180° lines at the edges.

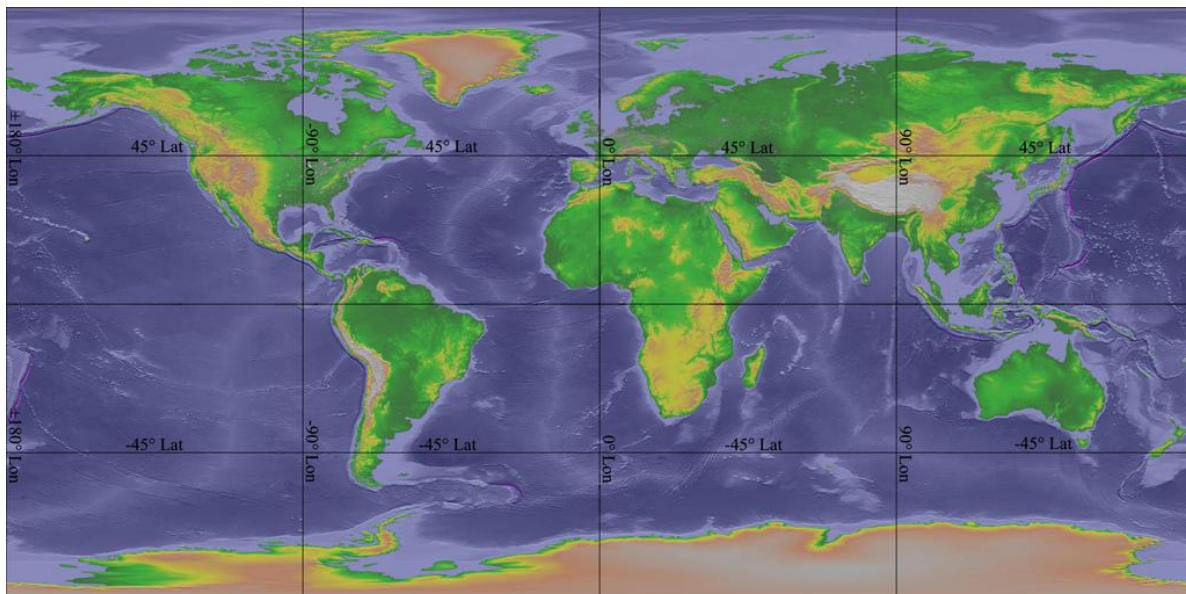


Image Format – JPEG or PNG for single images and image sequences

SOS will accept most common formats (JPEG, PNG, GIF, TIFF, etc.), but JPEG and PNG are preferred.

Video Format – MPEG4

Render the video with the MPEG4 video codec at a minimum of 25 mbps. Just because a file has a .mp4 extension does not mean it will play perfectly on SOS. Be sure to check the codec that was used to render the file. The H.264 codec causes errors in the SOS software.

Audio Format – MP3, MPEG4, WAV, OGG, AIF...

The audio player for SOS is fairly versatile and most common formats will work with SOS. The audio file can either be a standalone file or embedded in the same MPEG4 file as the video.

Resolution – 2048x1024 for videos, 4096x2048 for single images and image sequences

Higher resolutions are possible for the videos, but not all SOS systems in the SOS Users Collaborative Network are able to animate at 30 frames per second for higher resolutions. Make sure to render the videos with square (1:1) pixels for proper playback. If possible, a higher resolution copy of the image sequence used to generate the video should also be provided so that the video can be re-rendered at that high resolution in the future as the computers, software and projectors improve. For image sequences, the 4096x2048 frames will be rendered into a MPEG4 file that is 2048x1024 unless there is a specific reason to keep the animation as an image sequence. As with the video generation files, retaining the high resolution frames for the image sequence allows for re-rendering in the future at the higher resolution. For single images, resolutions above 4096x2048 are possible, though load time increases with resolution size.

Content Considerations

File Names – Based on Resolution, Time Stamp, and Content

Single images are typically named for their resolution, such as 4096.jpg. Images sequences are kept in folders that are named for their resolution, and the images themselves should be named to sort in ascending order from earliest to latest. This can either be done with a time stamp in the file name, or a frame number in the file name with a sufficient number of leading zeros to ensure proper sorting, shown in the example below. Videos should be named based on content and resolution, such as hurricanes_2048.mp4. By including the resolution in the file names, SOS users are able to easily determine what is available and appropriate for their system. Linux and the SOS software do not handle spaces and special characters in file names properly. *Do not use spaces and special characters in file names!*

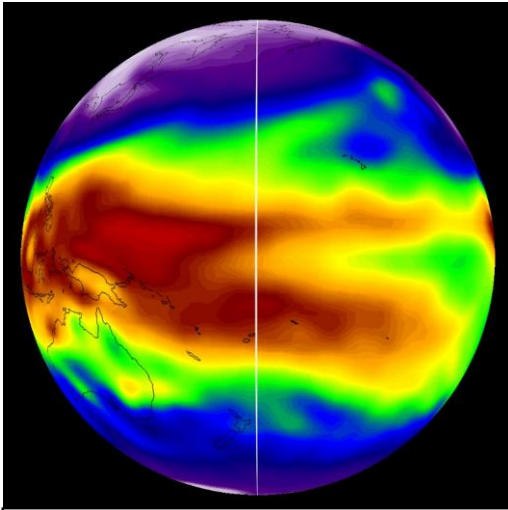
Named by date

```
snow_ice_2048_20110730.png
snow_ice_2048_20110731.png
snow_ice_2048_20110801.png
snow_ice_2048_20110802.png
snow_ice_2048_20110803.png
snow_ice_2048_20110804.png
snow_ice_2048_20110805.png
snow_ice_2048_20110806.png
snow_ice_2048_20110807.png
snow_ice_2048_20110808.png
```

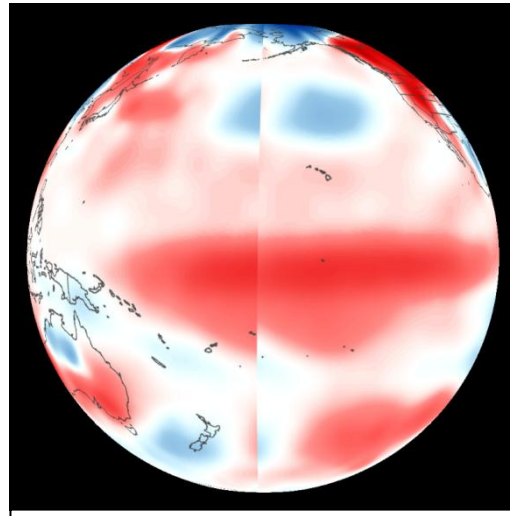
Named by frame count

```
sos_jpl_4096.0001.jpg
sos_jpl_4096.0002.jpg
sos_jpl_4096.0003.jpg
sos_jpl_4096.0004.jpg
sos_jpl_4096.0005.jpg
sos_jpl_4096.0006.jpg
sos_jpl_4096.0007.jpg
sos_jpl_4096.0008.jpg
sos_jpl_4096.0009.jpg
sos_jpl_4096.0010.jpg
```

Seams – A problem to be avoided



The data should take up the whole image, with no borders or extra space around the edges. Even a pixel border will show up as a seam! In most cases, a simple 1% stretch in the horizontal will fix the problem.



The data should match up at the edges of the image. If it doesn't, a seam will appear where the mismatch happens and it won't look seamless on the sphere.

In addition to making sure that the data fills the entire frame, from 180° West to 180° East, also make sure that the data fills the entire frame from 90° South to 90° North. If there is missing data at the poles, fill in the area with a solid color or a basic land/ocean background to ensure that the dataset wraps properly around the sphere without stretching vertically.

Labels – Identifying the dataset

Labels and legends are important. For every dataset that needs a timestamp, a file called labels.txt should be generated that contains one line for each frame in the image sequence or video. A labels.txt file cannot be used with a single image. Typically the labels include the date, but can contain any desired information, as seen below.

```
07/24/2004 06:45
07/24/2004 07:15
07/24/2004 07:45
07/24/2004 08:15
07/24/2004 08:45
07/24/2004 09:15
07/24/2004 09:45
07/24/2004 10:15
07/24/2004 10:45
07/24/2004 11:15
07/24/2004 11:45
07/24/2004 12:15
```

```
SSEC 08/31/2005 Katrina
SSEC 08/31/2005 Katrina
SSEC 08/31/2005 Katrina
SSEC 08/31/2005 Katrina
SSEC 08/31/2005 Maria Katrina
SSEC 09/01/2005 Maria
SSEC 09/01/2005 Maria
SSEC 09/01/2005 Maria
SSEC 09/01/2005 Maria
SSEC 09/01/2005 Maria
SSEC 09/01/2005 Maria
SSEC 09/01/2005 Maria
```

Labels should not be “burned in” the images themselves due to warping. Also, when labels are “burned in” they can be rotated out of view and tilted at odd angles when a presenter is interacting with the sphere. The position of the labels that appear from the labels.txt file is

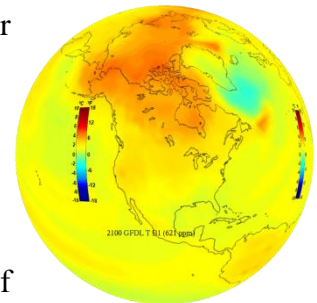
stationary as the sphere is rotated. While the position and color of the labels can be adjusted with the software, the font and size cannot be adjusted at this time.

In addition to using the labels.txt file, there are other ways of labeling the content that is on the sphere. Colorbars and legends can be added using the picture-in-a-picture feature. As with the timestamps, do not “burn in” colorbars and legends. Make sure to test the size and fonts of colorbars and legends on the sphere to ensure legibility. It seems that most colorbars and legends are too small and have to be increased in size when actually displayed on the sphere.

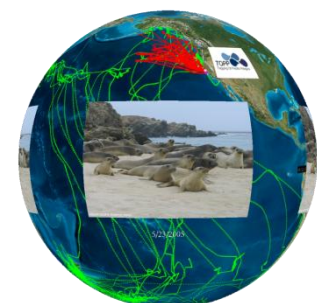
The purpose of adding labels to the sphere is to aid the visitor in understanding the dataset. Consider using pictographs for scales because they have been found to be intuitive and beneficial for visitor understanding. Also, using country or city labels can help visitors orient themselves in a global context. Another suggestion is to use vertical temperature colorbars because that is how most visitors are accustomed to reading thermometers. Size, orientation and placement of colorbars and legends are important for improving the visitor’s understanding of the dataset.

Picture-in-a-Picture – Enhancing the dataset

A Picture-in-a-Picture, or pip, can be used to enhance an existing dataset or provide supplementary documentation. Logos, images, colorbars and legends are often added as pips. When used for a colorbar, a pip can help label a dataset, as seen at right. As with the labels, it is not recommended to “burn in” the pips. Leave it as an additional image file that can be added in the playlist.sos file. This gives the user complete control over the position and size of the pip. In general, nothing should be “burned in” to the frames for a dataset because pips provide a better way of labeling the dataset.



A pip can also be used to provide a close-up view of a region or give the viewer additional context for what they are seeing. In the example at middle right, the underlying dataset shows the tracks of elephant seals in red, and the pip is a picture of actual elephant seals. Multiple pips can be shown at the same time, or staggered to create a slideshow effect. Make sure to consider the placement of the pip in order to not block information in the underlying dataset, especially if the pip is displayed for an extended period of time.



By using pips that are PNG’s with a transparent background, many different shapes can be projected on the sphere with the underlying dataset as a background. Pips can set to display in specific locations on the sphere as markers, as seen at lower right. Here each pushpin is a pip that identifies the location of a SOS installation.



Standard pips shouldn’t be any larger than 1024x1024 in resolution size. Pips that are set to wrap around the entire sphere can be up to 4096x2048. Be aware that overlapping and warping can occur if the display size of a pip is set too large. Make sure to test each dataset

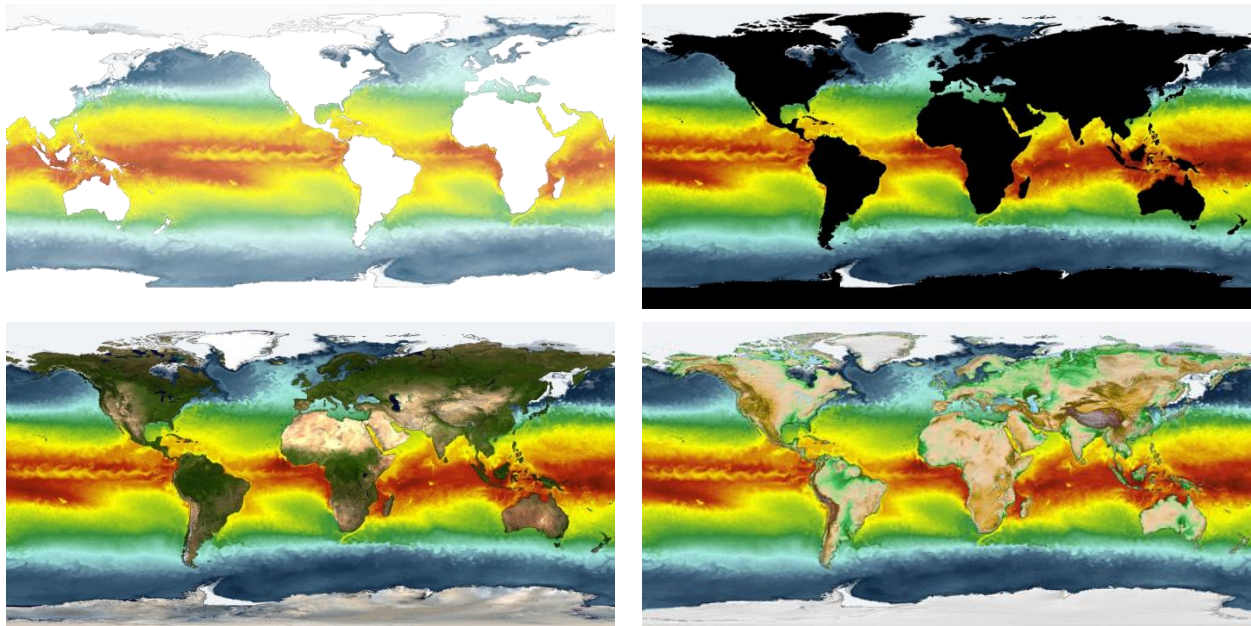
before distributing it to others, checking the pip size, placement and timing. The display size can be adjusted using pipheight and pipwidth. Pips can also be MPEG4 files or image sequences.

Full documentation of the pip options can be found in the Playlist Format:

http://sos.noaa.gov/docs/pl_3_2_x.html

Layers – Adding flexibility to the dataset

By using a standardized map projection and orientation, layers with transparency can be used to add flexibility to the visualization. For example, rather than burning in a land map in a dataset of sea surface temperature, the land can be left transparent. This allows the land background to be easily changed, as seen below. The PNG file format supports transparency.



Warping – Something to be aware of

When working with a spherical surface, warping is always something to consider. The least amount of warping occurs near the equator, while the most warping occurs at the poles. Because of this, it is recommended that any text and labels are placed near the equator. Supplementary text, labels and images that are displayed as pips don't warp if their position is set with pipcoords. Datasets can be tested for warping issues using CC Sphere in Adobe After Effects or 3D Sphere in Photoshop. There are some plugins for After Effects such as Cycore Effect's Sphere Utilities that can also help with spherical warping. In addition, these programs can be used to check for seams.

Color Suggestions

A color scale can dramatically change the emphasis and message of a dataset. Because of this, the Science On a Sphere Users Collaborative Network has had many discussions on the color scales that are used for SOS datasets. The goal is to create datasets with well chosen color scales that are meaningful, intuitive, and scientifically accurate. Several conclusions are the result of these discussions:

1. It can be confusing to users when the same color scheme and their associated color bars are used for two completely unrelated datasets.
2. The same color should not be used to represent more than one thing. i.e. if ice is shaded white, then white should not also be used for areas of missing data.
3. Using rainbow-colored legends and color schemes is often confusing to the audience and hard to parse. Instead, consider using shades of green to represent phytoplankton, and blue and red gradations to represent temperature anomalies. i.e. use “meaningful” colors
4. Avoid using full sphere backgrounds that are completely or pre-dominantly white. The seams between projectors become more apparent when using solid white/bright backgrounds. If using bright background colors, consider adding some noise/texture to them. Same goes for PIPs, especially those displayed at the seams between projectors.

Tools Used – To create Science On a Sphere visualizations

- Because Science On a Sphere[®] uses basic image formats like JPEG, and PNG as its main input format, there are many tools available for creating SOS datasets. Common examples are Photoshop[®], ImageMagick[®], GIMP, etc.
- The SOS system comes with a script called “convert2mpeg4” to convert an image sequence to an MPEG4
- For creating MPEG4 files with transitions, special effects and narration, programs such as FinalCut Pro[®] and Adobe After Effects[®] are useful.
- Tools like IDL, AWIPS, McIDAS, and other image analysis applications are typically used to create imagery from scientific data sets. Graphics designers can use a 3D modeling applications, like 3D Studio[®], to create advanced visualizations.

For More Information

The following article, researching the public understanding of science content, was written by SOS Users Collaborative Network members:

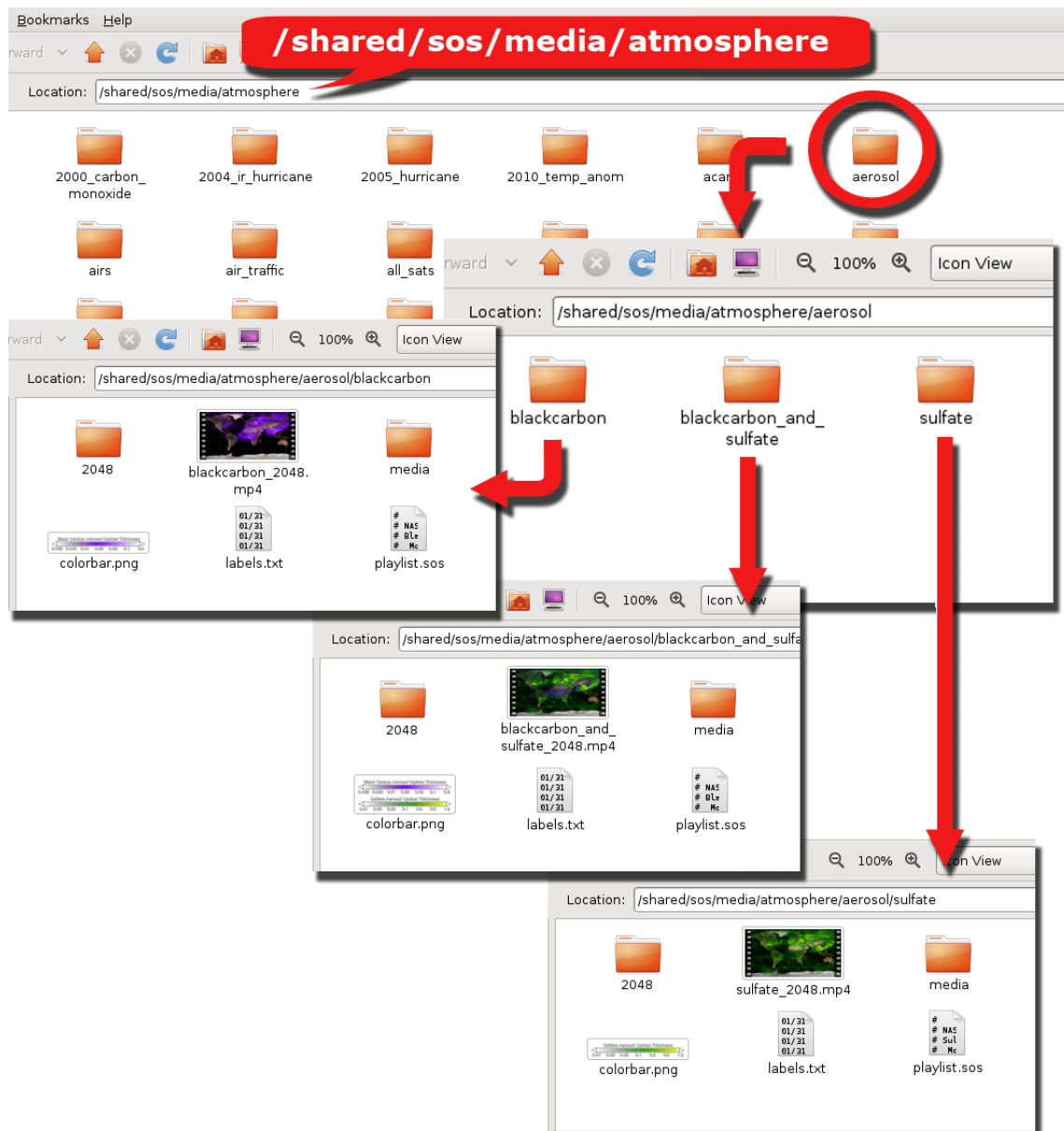
Phipps, M. and Rowe, S. (2010) Seeing satellite data Public Understanding of Science.
doi:10.1177/0963662508098684

Submitting a Dataset

Content Materials

Every dataset that is added to the SOS Data Catalog should be in its own individual folder that is stored in appropriate category folder in `/shared/sos/media`. Complimentary or similar datasets can be grouped together in a folder that contains individual folders for each dataset. Each folder, at very minimum should contain a `playlist.sos` file and either an image, image sequence or video. In addition to those required pieces, folders can also contain:

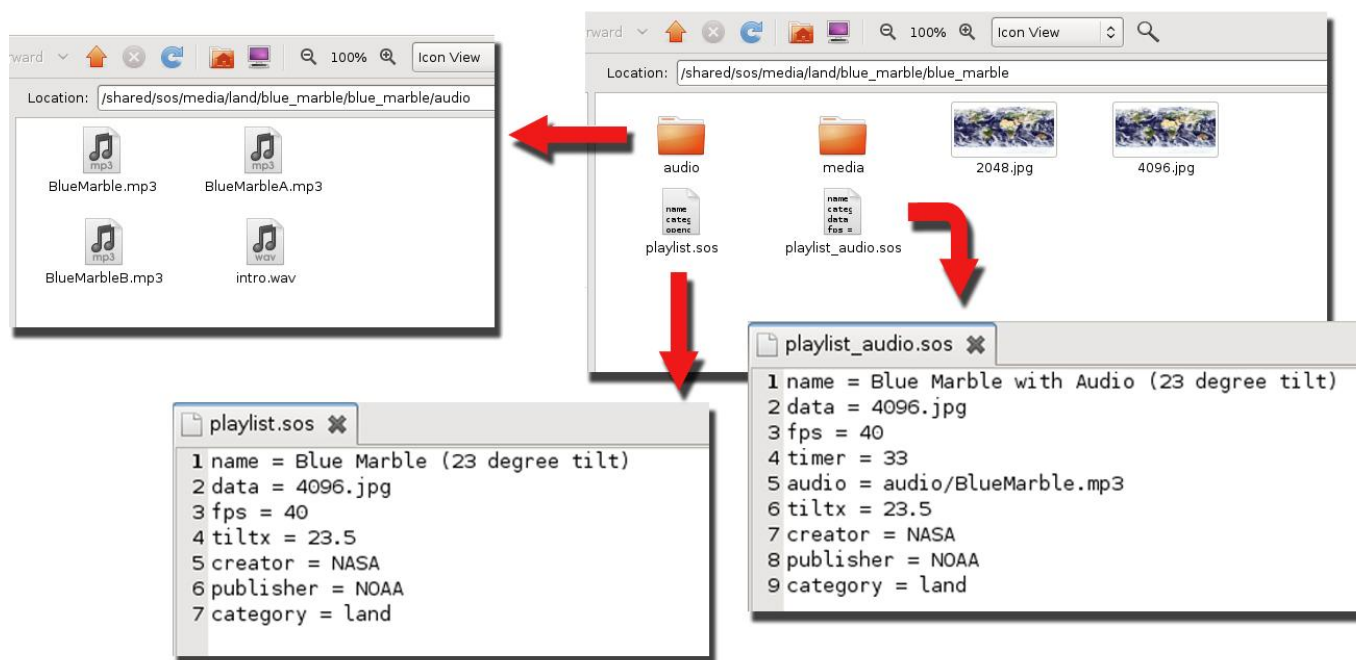
- Image, Image Sequence or Video – **required**
- Playlist.sos file – **required**
- Labels file
- Audio file
- Picture-in-a-Picture images, image sequences, and/or videos
- Colorbars
- Scripts or supplementary materials
- Media folder with thumbnails and videos (typically created by the SOS team)



In the above example, there are three datasets that are related and all from the same source. To keep them together, a folder was created in the atmosphere category called aerosol. In the aerosol folder, each dataset was given its own folder: sulfate, blackcarbon, and blackcarbon_and_sulfate. Notice that there are no spaces in the names! In each of the individual dataset folders there is an image sequence named for the resolution of the frames, a MPEG4 video, a media folder with thumbnails, a colorbar, labels, and a playlist.sos.

Playlist.sos File

Every dataset should have its own playlist.sos file. There can be multiple playlist.sos files in the same folder, such as playlist.sos and playlist_audio.sos, as long as they reference the same dataset. When working with multiple datasets, they should each be in their own folder with their own playlist.sos file, as shown in the aerosol example. No playlist.sos file should point to multiple datasets.



In this blue marble example, there are two playlist.sos files in the folder for the blue marble dataset, `playlist.sos` and `playlist_audio.sos`. Both playlists point to the same data, and the only difference is that one includes audio and a timer and the other doesn't. The playlist.sos filename must start with `playlist` and end with `.sos`, but anything can be added between, such as `_audio` or `_with_pips`. Notice that the audio files have been put into their own folder. If there are multiple audio files or pips, a folder can be created in the dataset folder that contains those files. While this isn't required, it helps to keep the folder uncluttered.

When files that are referenced in the `playlist.sos` aren't in the same directory as the `playlist.sos`, the path to the file needs to be included. Take note in the `playlist_audio.sos` file how the audio points to `audio/BlueMarble.mp3` since the `mp3` file isn't in the same directory as the `playlist.sos`. Either relative paths (`audio/BlueMarble.mp3`) or full paths (`/shared/sos/media/land/blue_marble/blue_marble/audio/BlueMarble.mp3`) can be used in the `playlist.sos` files. Be careful to avoid typos, as the dataset won't work if anything is wrong!

There are many optional settings that can be included in the playlist.sos file. At minimum the playlist.sos file should contain the following elements:

```
name = Blue Marble
data = 4096.jpg
creator = NASA
publisher = NASA
category = land
keywords = land, Earth, Blue Marble, NASA
```

The playlist.sos file should be formatted according to the specifications found here:

http://sos.noaa.gov/docs/pl_3_2_x.html The category should be one of the existing SOS library categories of land, ocean, atmosphere, astronomy, models and simulations, extras, and live programs.

Written Material

In addition to the above material, a written description of the dataset, a list of “Notable Features,” and a list of credits are also requested. All of this documentation is used to create an entry in the SOS Dataset Catalog, as seen at right. The written description should be a simple overview of the dataset that highlights the source of the data, whether it is modeled or measured, what it shows, and why it’s important. It should be a non-technical description that is easily understood. The “Notable Features” is a bulleted summary of the highlights from the description that presenters can use when showing the dataset to viewers. The credits are used to fill in the table at the bottom of the page. The credits listed are:

- Data Set Source
- Data Set Developer
- Visualization Developer

These can be the same for each listing, or all different and can include links to the original sources. For existing examples, visit the SOS Dataset Catalog: <http://sos.noaa.gov/datasets/>

Presentation Playlists

To group multiple datasets together, create a playlist, such as hurricanes.sos, that points to each individual playlist.sos file with the full path included. These playlists are to be stored in /home/sos/sosrc or /home/sosdemo/sosrc . Here is an example playlist that groups multiple datasets together:

```
include = /shared/sos/media/land/blue_marble/playlist.sos

include = /shared/sos/media/atmosphere/carbon_tracker/playlist.sos

include = /shared/sos/media/astronomy/mars/playlist.sos
```

Playlists that group multiple datasets together can be named anything as long as they end with .sos. Playlists can either be typed by hand, or created using the Playlist Editor. In order for datasets to appear in the Playlist Editor, the library must be updated in the SOS Stream GUI.

The screenshot shows the 'Science On a Sphere' website interface. The main heading is 'Aerosol Dispersion - FIM-Chem Forecasting Model'. Below this, there is a 'Description' section with text about the FIM-Chem model and aerosol forecasting. To the right of the description is a small globe visualization. Below the description is a 'Notable Features' section with a bulleted list. To the right of this list is a color-coded legend for aerosol types: Black Carbon (red), Organic Carbon (blue), and Dust (green). Below the legend is a 'Data Category' section with a table listing metadata. The table has two columns: 'Data Set Name' and 'Data Set Description'. The table lists the dataset as 'FIM-Chem model - Three Aerosol Species' and provides details about the data source, developer, and visualization.

Data Set Name	Data Set Description
FIM-Chem model - Three Aerosol Species	Am, chem
NOAA FIM-Chem Model	NOAA FIM-Chem Model
NOAA FIM-Chem Model	NOAA FIM-Chem Model
Visualization Developer	Steve Albert, NOAA OSD
Audio	No
Science Contact	Georg Orell, NOAA OSD
Visualization Contact	Steve Albert, NOAA OSD
Downloaded	7/7
Date Added	July 2010